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EXAMINER	
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ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/776,466	KODIALAM ET AL.	
	Examiner	Art Unit	
	Andrew Lai	2616	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 24 October 2007.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-19 is/are pending in the application.

4a) Of the above claim(s) 15 and 16 is/are withdrawn from consideration.

5)☒ Claim(s) 12-14 and 17-19 is/are allowed.

6)☒ Claim(s) 1-3,5-9 and 11 is/are rejected.

7)☒ Claim(s) 4 and 10 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 11 February 2004 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims **1** and 2,5,6,11 are rejected under 35 U.S.C. 102(b) as being anticipated by Grover et al (US 202/0071392, Grover hereinafter).

Grover discloses a "design of a meta-mesh of chain sub-networks" (p1 lines 1-2) "that include plural nodes terminating plural spans" ([0023] lines 3-4) comprising the following features.

Regarding claim 1, *a method* (see "a method of restoring a telecommunications method" recited [0023] line 2) *of partitioning capacity of a network* (see e.g. fig. 1) *into working capacity and restoration capacity* (see "we consider span-restorable networks where the routing of working paths (and hence working capacity) is jointly optimized with spare capacity assignment to minimize total capacity" recited [0016] lines 9-12 wherein "spare capacity" is used as *restoration capacity* as recited [0006] lines 2-5 "achieve 100% restorability against any single span failure either through network protection or restoration using a designed-in allocation of spare capacity"), *the method comprising the steps of:*

(a) generating a set of network constrains (see [0021] for constraints formulas (2), (3), (4), and (5) wherein "**Constraints** (2) ensure that all working demands are routed. **Constraints** (3) generate the required working capacity on each span j to satisfy the sum of all (pre-failure) working demands routed over it. **Constraints** (4) ensure that restoration for failure of span I meets the target level of 100%. **Constraints set** (5) forces sufficient spare capacity on each span such that the sum of the restoration paths routed over that span is met for failure of any span I" recited [0022] line 2 on p3 – [0022] line 9 on p4) *for a network of nodes interconnected by links in accordance with a network topology* (see fig. 4 which "is a schematic showing 'meta-mesh' topology of the network in fig. 1" recited [0032] lines 1-3), *wherein the network constraints include:*

1) for each link, a set of one or more detour paths exist (see "Span restoration is like deploying a set of detours around the specific break" recited [0015] lines 4-5) *whose capacities sum to the working capacity of the link* (see [0021] formula (4) and "Constraints (4) ensure that restoration for failure of span I meets the target level Of 100%" recited p4 left col. lines 2-3 noting wherein formula (4) w_j denoting "the number of working capacity unites on span *j*" as recited last lime of the list immediately above [0021] and f_i^P denoting "Restoration flow assigned to p^{th} eligible restoration route for span *i*" as recited line 12 of the list immediately above [0021]);

2) for each link, the sum of the working capacity and the restoration capacity shared by the set of detour path is, at most a total capacity of the link (see [0021] formula (2) and formula (5), wherein firstly "Constraints (2) ensure that all working demands are routed" recited [0022] lines 2-3 wherein formula (2) d^r denoting "Number of

demand units for O-D [origination-destination] pair *r*" recited line 4 of the list immediately above [0021] and $g^{r,q}$ demoting "Working capacity assigned to the q^{th} eligible working route for demand pair *r*" recited lines 14-15 of the list immediately above [0021], and <u>secondly</u> "Constraint set (5) forces sufficient spare capacity on each span j such that the sum of the restoration paths routed over that span is met for failure of any span i" recited p4 left col. lines 3-6, noting that since both constraints (2) and (5) must be met simultaneously, the combination of the two constraints ensures the claimed limitation); *and*

3) the working capacity of the network is maximized (see [0021] formula (3) and "Constraints (3) generate the required working capacity on each span *j*" recited [0022] lines 3-4 noting again the description for $g^{r,q}$ and w_j in the list immediately above [0021]).

(b) formulating a linear programming problem (LPP) for the network topology based on the set of network constraints (see "The design of span-restorable mesh network is most often approached using an arc-path Interger **Linear Programming (IP) formulation** introduced for SCA [20]. As our benchmark here we will use an extension of the model [20] to include joint optimization of the working path routing" recited [0020] lines 1-6 wherein "model [20]" is given by Herzberg et al as cited in [0112]); *and*

(c) generating either an exact or an approximate solution for the LPP, the solution including a working capacity and a restoration capacity (see "Once planned, the **resulting** telecommunications network may be implemented" recited [0027] lines 1-2 and further "Once built, the same process can be used for ongoing **decisions** about which equipment elements in the chain to **rout a new demand** [*working* capacity]

through and where in the network, **spare** capacity [*restoration capacity*] needs to be augmented to ensure **restorability**, if anywhere" recited [0027] lines 7 – 9. See additionally fig. 8, as an example, depicting curves for *working capacity and restoration capacity* in terms of "working channels" with symbol ▲ and "spare channels" with symbol ■, respectively) *of each link of the network* (see [0021] for "JCA [joint capacity assignment]" equation (1) "$\sum_{j\varepsilon S} c_{j\Pi} L_j (w_j + s_j)$" with w_j denoting "the number of working capacity unites on span *j*" and s_j "the number of spare [restoration] capacity units placed on span *j*" as recited in the list immediately above [0021].)

Regarding claim 2, *the invention of claim 1, further comprising the step of d) partitioning the capacity of each link of the network based on the solution for the LPP* (see [0021] for "JCA [joint capacity assignment]" eq. (1) "minimize $\sum_{j\varepsilon S} c_{j\Pi} L_j (w_j + s_j)$" with w_j denoting "the number of working capacity unites on span *j*" and s_j "the number of spare [restoration] capacity units placed on span *j*" as recited in the list immediately above [0021].).

Regarding claim 5, *the invention of claim 1, wherein, for step (b), the LPP is a path-indexed LPP formulation* (see "The resultant designs comprise a special class of restorable network that is intermediate between pure span restoration and **path restoration**. Most of the efficiency of path restoration is achieved" recited Abstract lines 19-22).

Regarding claim 6, *the invention of claim 5, wherein step (c) further comprises the step of (c1) generating a dual of the path-indexed LPP formulation* (see "Constraint set (5) from the JCA formulation is also modified to capture the **dual-failure** scenarios

when a chain span is cut causing its bypass span to simultaneously fail" recited [0058] lines 1-3).

Regarding claim 7, *wherein step (c) further comprises the step of (c2) approximating the solution* (see "it is believed that span restoration on the meta-mesh abstraction of a sparse graph can approximate the restoration on the full graph" recited p11 left col. lines 13-15).

(note: Grover does not disclose a $(1 + \varepsilon)$ approximation formulation, which will be discussed further below)

Regarding claim 11, *the invention of claim 1, wherein, for step (2), the network is either an electro-optical network or a packet-based network* (see "these schemes are fairly easily mapped into DWDM implementations between **opto-electronic** cross connects" recited [0016 lines 16-18).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Grover et al (US 2002/0071392, Grover hereinafter) in view of Hauser et al (Capacity design of Fast Path Restorable Optical Networks, *IEEE INFOCOM 2002, p. 817 – 826*, Hauser hereinafter).

Grover discloses claimed limitations as applied above in paragraph 2 to claim 1. Grover does not disclose the following feature of **claim 7**:

[... *approximating the solution*] *with a (1+ε) approximation algorithm.*

Hauser discloses "fully polynomial approximation schemes that solve the restorable network capacity design problem" (p817 Abstract last three lines) comprising the following feature of **claim 7** of [... *approximating the solution*] *with a (1+ε) approximation algorithm* (see "We the use a primal dual approach to develop a Fully Polynomial Time Approximation Scheme (FPTAS). The idea in FPTAS is to obtain an ε optimal solution to the problem. An ε optimal solution to the maximizing problem that has a value at least (1- ε) times the optimal solution." recited p820 left col. last paragraph).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the approximation formulation of Grover by incorporating the particular (1+ε) approach of Hauser into Grover in order to provide a more efficient and practical mechanism leading to "algorithm for network capacity desing that explicitly accounts for fast restoration requirements" as pointed out by Hauser (p817 Abstract lines 10-11).

5. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Grover et al (US 2002/0071392, Grover hereinafter) in view of Saito (US 6,404,744).

Grover discloses claimed limitations as applied above in paragraph 2 to claim 1. Grover does not disclose the following feature of **claim 9**, *the invention of claim 1, wherein, for step (b), the LPP is a link-indexed LPP formulation.*

Saito discloses "A method for designing a communication network" (Abstract lines 1) wherein "Stochastic constraints are generated by using the requested capacity of a demand to produce a stochastic programming problem" (Abstract lines 2-5, noting that "stochastic programming problem" is a variation of *linear programming program* as well known in the art) comprising the feature of

claim 9, *the invention of claim 1, wherein, for step (b), the LPP is a link-indexed LPP formulation* (see fig. 3 step S306 "transform a stochastic programming problem formed of the objective function and the constraint expressions into an equivalent determinate programming problem" and step S307 "solve the equivalent determinate programming problem and thereby obtain capacities of <u>respective links</u> and nodes").

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Grover by adding the link indexed approach of Saito (note that Grove already implied <u>link</u> oriented solution in his "pan" oriented approach. See e.g. [0008] lines 13-16 "Each working capacity unit of a span is thus part of a logical link in a client service-layer network, all such links being destined to fail together if the corresponding physical span fails.") in order to provide a more robust mechanism for "a communication network design method that is capable of accommodating traffic varying due to variations in demand pattern" as pointed out by Saito (col. 1 lines 12-14).

Allowable Subject Matter

6. Claims 4, 8 and 10 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 4, 8 and 10 depend from **claim 1**.

Claim 4 recites:

The invention of claim 1, wherein for step (b), the LPP formulation is generated for the network having an equal partition size for the working capacity and restoration capacity of each link e of a set E of links in the network, and step (c) generates the solution based on a fraction α for the equal partition size the fraction α given by

$$\alpha = \min_{e \in E} [F(e)/(u_e + F(e))]$$

where "min(•)" denotes the mathematical "minimum of •", u_e is the capacity of link e and $F(e)$ is the maximum flow value between nodes coupled by e when e is removed from the network.

Claim 8 recites:

The invention of claim 5, wherein for step (c), the path-indexed LPP formulation is given by:

$$\max \sum_{e: e \in E} \sum_{P: P \in P_e} f(P), \text{ subject to}$$

...

... where max(•)... and $f(P)$ denotes the restoration traffic on a given path P after failure of the link that it protects.

Claim 10 recites:

The invention of claim 9, wherein for step (b), the link-indexed LPP formulation is given by:

$$\max \sum_{(k,l) \in E} x_{kl}$$

$$\sum_{j:(i,j) \in E} y_{ij}^{kl} - \sum_{j:(j,i) \in E} y_{ji}^{kl} = \begin{cases} x_{kl} & \text{if } i = k \\ -x_{kl} & \text{if } i = l \\ 0 & \text{otherwise} \end{cases}$$

.... (rest of mathematical expressions omitted)

wherein i, j, k, and l are indices corresponding to node numbers, "$max(\bullet)$" denotes the mathematical "maximize $\bullet$", N denotes a set of nodes in the network, E denotes a set of links in the network, u_{ij} denotes the capacity of link (i,j), x_{ij} ($0 \le x_{ij} \le u_{ij}$) denotes a working capacity reserved on link (i,j), y_{ij}^{kl} denotes a network flow equal to x_{ij} from node k to node l using links other than (k,l).

The believed to be closest prior arts of Grover (US 2002/0071392) and/or Saito (US 6,404,744), singularly or in combination, fails to anticipate above features or render them obvious.

7. Claims **12**-14, **17**, **18** and **19** are allowed.

Claim 12 is currently amended and recites the following allowable features, especially those underlined:

(a) determining a link e and a corresponding shortest path P that minimize a combination of i) a sum of shortest-path weights of the corresponding path P when e fails and ii) a sum of the link weights when each other link not in the corresponding path P fails

...

(d) incrementing, by the minimum capacity, the working capacity on link e and the restoration capacity of each link in the given path P; and

(e) repeating step (a) through (e) until a set of dual network constraints are satisfied.

The believed to be closest prior arts of Grover (US 2002/0071392) and/or Saito (US 6,404,744), singularly or in combination, fails to anticipate above features or render them obvious.

Claims 13 and 14 depend from claim 12 and thus are allowed.

Claims 17, 18 and 19 are newly added claims as a result of Applicants' amendments. **Claims 17, 18 and 19** contains essentially the same allowable subject matters outlined above regarding claims 4, 8 and 10, respectively. Therefore said claims 17, 18 and 19 are allowed on the same ground as those stated above regarding claims 4, 8 and 10, respectively.

Response to Arguments

8. Applicant's arguments filed 10/24/2007 have been fully considered but they are not persuasive.

Applicant's arguments are essentially drawn to a particular feature of original claim 3, which is currently cancelled by incorporating the feature into claim 1 with certain amendments. In this regard, Applicant argues over Gover's constraint (2) by saying (page 8 second paragraph) "This [Gover's constraint (2)] is not the same as the Applicant's constraint 2", wherein Applicant's constraint 2 states "*for each link, the sum of the <u>working capacity</u> and the <u>restoration capacity</u> shared by the set of one or more detour paths is, at most, a total capacity of the link*". Applicant further equates this to Applicant formula (8) (page 8 paragraphs 3, which formula is not recited here due to its complexity) wherein the quantity $f(P)$ appears in two summations, which $f(P)$ "denotes the <u>restoration traffic</u> on a given path P after failure of the link that it protects", see, e.g. claims 8 and 18.

Examiner respectfully disagrees with the equating of Applicant's constraint 2 to said formula (8) because constraint 2 is with respect to <u>both</u> *working/restoration capacities* while formula (8) recites about only the *restoration traffic.*

Additionally, even taking Applicant's constraint 2 as the same as formula (8), Gover discloses simultaneously satisfying his constraint (2) and constraint (5), as recited above in paragraph 2 regarding claim 1. Such combination of constraint (2) and (5) of Gover effectively teaches the same constraint of Applicant's formula 8.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 5,854,903 provides a method for network optimization based on multirate, circuit-switched analysis determined as a solution to a set of linear equations.

US 6,086,619 discloses an apparatus and method for modeling optimization problems using linear and quadratic programs.

US 4,744,027 teaches a method and apparatus for optimizing the operational state of a system employing iterative steps approximately following a projective scaling.

US 2002/0167898 discloses restoration of IP networks using precalculated restoration routing tables.

Yijun Xiong et al (IEEE/ACM Transactions on Networking, Vol. 7 No. 1 (Feb. 1999)) studies the capacity and flow assignment problem arising from the design of self-healing ATM network using the virtual path concept.

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andrew Lai whose telephone number is 571-272-9741. The examiner can normally be reached on M-F 7:30-5:00 EST, Off alternative Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kwang Yao can be reached on 571-272-3182. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

KWANG BIN YAO
SUPERVISORY PATENT EXAMINER

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